

DOCUMENT RESUME

ED 307 133

SE 050 588

AUTHOR Sheft, Andrea
TITLE The Application of Children's Mathematical Intuition
to an Elementary Curriculum.
PUB DATE 89
NOTE 15p.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Cognitive Development; Curriculum Development;
*Discussion (Teaching Technique); *Elementary School
Mathematics; *Intuition; Kindergarten; Learning
Activities; *Manipulative Materials; *Mathematical
Concepts; Primary Education; *Student Motivation

ABSTRACT

This document suggests ways of using children's intuitive ideas about mathematics as a starting point for an elementary curriculum. Ways are discussed to capitalize on what children already know: to cultivate rather than discourage students' intuitive mathematical sense, and to help students make connections between what they know and what they are learning. It includes discussions of utilizing manipulatives to demonstrate relationships of mathematics to the real world, children's literature to aid understanding of mathematical concepts, and children's communication to discuss possible ways of solving a problem. Twelve references are listed. (DC)

* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *

ED307133

The Application of Children's Mathematical
Intuition to an Elementary Curriculum

Andrea Sheft

Dominican College

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)

☒ This document has been reproduced as
received from the person or organization
originating it.

☐ Minor changes have been made to improve
reproduction quality.

• Points of view or opinions stated in this docu-
ment do not necessarily represent official
OERI position or policy.

"PERMISSION TO REPRODUCE THIS
MATERIAL HAS BEEN GRANTED BY

Andrea Sheft

TO THE EDUCATIONAL RESOURCES
INFORMATION CENTER (ERIC)."

Running head: CHILDREN'S MATHEMATICAL INTUITION

SE 050 588

Abstract

This Document suggests ways of using the children's intuitive ideas about mathematics as a starting point for an elementary curriculum. It includes discussion about utilizing manipulatives, children's literature, and communication to enhance a mathematics program.

The Application of Children's Mathematical
Intuition to an Elementary Curriculum

Introduction

"In teaching mathematics to young children, we must look at the world through their eyes" Baratta-Lorton, (as cited by Radebaugh, 1981, p.902). It is important to recognize that children have many mathematical ideas, correct and incorrect, and that they bring these preconceived ideas into every lesson (Suydam, 1987). As educators, we need to encourage children to utilize, as a starting point for their formal mathematics education, the knowledge that they bring with them into the classroom when they first enter school. In this way the students will begin a study of mathematics concepts that will be meaningful to them, because the new ideas will be connected to what they already know.

Statement of the Problem

What mathematics instruction techniques can teachers adopt in order to be effective at utilizing children's own mathematical ideas, and to promote success in the study of advanced mathematics later in life?

Rationale

Suydam (1987) discovered the following:

Research indicates that before they come to school, young children can solve a variety of problems usually by using counting or by modeling the problem situation with concrete objects. Yet very soon after they begin school, they "lose" some of this ability- as they attempt to follow the procedure their teacher has demonstrated, as they attempt to do with paper and pencil what once seemed natural with counting and materials. They perceive of school mathematics as a "follow the leader" game, rather than a natural activity in which you use what you know in order to solve a problem (p.6).

One explanation for this observation is the current focus in mathematics education on written answers. Young children cannot concentrate on the learning of sums and the writing of the numbers simultaneously (Kamii, 1982). The writing process interferes with the learning objective-remembering sums. Having to produce a written answer for every problem in order to satisfy the teacher prevents the children from inventing their own purpose for learning. The writing of answers should be used as another tool for learning, but should not be perceived by the student as the reason for completing

the problem (Kamii, 1982).

A balance should be maintained between internal meaning and computational skill. "Teaching meaningfully consists in directing learning in such a way that children ascend, as it were, a stairway of levels of thinking arithmetically to the level of meaningful habituation in those aspects of arithmetic that should be thoroughly mastered, among them basic computational skills" (Brownell, 1987, p.22).

Background and Need

Young children construct many of their mathematical ideas based upon their personal experiences. They come to school with the ability to deal with many mathematical tasks (Weaver, 1987). Children are able to develop accurate mathematical ideas, an intuitive sense about addition for example, based upon their early experiences in the world. It makes sense, therefore, that if this ability were cultivated during the formal schooling process, then this intuition would still be intact later in life, when students tackle more complex mathematical problems.

Assessment data indicates that students can compute well using whole numbers until they are faced with word problems (Suydam, 1987). If computations are presented

initially in a way that connects them to language, then there will be fostered an inherent relationship between them. With this relationship already established, it would not be necessary to present word problems later on in a way disjointed from the child's own experience. Thus, what we teach to students must be connected to what they already know. It is the responsibility of the teacher to help the student to make these connections (Suydam, 1987). According to Piaget, "Every normal student is capable of good mathematical reasoning if attention is directed to activities of his interest, and if by this method the emotional inhibitions that too often give him a feeling of inferiority in lessons in this area are removed" (cited in Kamii, 1982, p.251).

There are many creative ways of teaching mathematics that draw upon young children's internal ideas about mathematics, and their experiences within their environment. By using problems and examples that are taken from the student's personal experiences, rather than from a workbook, students can recognize the value of their learning (Della Neve, Hart, & Thomas, 1986). Examples of ways in which educators can do this include using manipulatives, using children's literature, and using discussion techniques which

capitalize on the student's ability to reason mathematically within a small group.

Manipulatives

Manipulatives are concrete objects, such as pattern blocks, which are used to demonstrate to students the relationship of mathematics to the physical world. The current popularity of using manipulatives is based on a large body of evidence that suggests that students understand and remember abstract ideas more easily when these concepts have been reinforced with physical objects (Willoughby, 1988). The research also implies that students who are introduced to new concepts using manipulatives are better equipped to transfer that knowledge to other incidences derived from their own experiences than students who have not used manipulatives.

The research from several studies also has indicated that lessons in which manipulatives were used were more successful than lessons in which manipulatives were not used (Suydam, 1987). This finding indicates that children learn better through concrete experience than by simply being lectured at by the teacher. According to Della Neve et al (1986):

Students need to be in command and to "push things

around" rather than merely accept directions. Brain compatible instruction encourages youngsters to work towards goals and to explore a range of means. Materials that can be manipulated by students and the general resources that facilitate manipulation must be provided for in abundance (p.146).

As teachers, we need to help children to develop an individual reason for doing mathematics. Manipulative materials are useful in developing in students an inherent sense of the meaningfulness of mathematics. Activities that make use of manipulatives, such as building a house, or having a class store, are also ways of connecting mathematics inextricably to the real world. Once students have become efficient at solving problems using materials they should then be able to apply the acquired skills to more complex mathematical situations (Willoughby, 1988).

Children's Literature

The use of books to aid in children's understanding of mathematical concepts is often neglected (Ballenger, Benham, & Hosticka, 1984). Books are an excellent resource to use to supplement the traditional mathematics materials (Harsh, 1987). Children's books

are useful with individuals and with groups (Smith & Wendelin, 1981). The intended result in the presenting of academic concepts using children's books is that the student will develop a particular mathematical skill while enjoying the story (Ballenger, Benham, & Hosticka, 1984).

According to Lowe, Orlando, and Surat, (1987) children's literature can be used to teach mathematical concepts such as numbers, place value, addition and subtraction, probability, and fractions. "Using children's literature as a springboard for mathematical experiences allows language and mathematics to grow together naturally and imaginatively" (Radebaugh, 1981, p.906).

Books that do not focus on mathematical concepts can still be utilized in a program aimed at specific mathematical skills. Although these books do not deal directly with the concepts being taught, they are useful in reinforcing them. For example, any story can be used to teach the concept of ordinal numbers. After reading a story, the children can be asked questions such as: "What is the first thing that happened? What happened next?" Later the students could illustrate the different events in the story and label them "first",

"second", "third," and so on (Harsh, 1987). A similar activity could be designed using a song or a nursery rhyme.

Using books for educational purposes fits into the recommended learning sequence in which concrete experiences precede semiconcrete experiences. Children can first practice prenumber concepts using manipulatives, listen to or look at books that reinforce these concepts, and then ultimately go on to solve abstract problems that involve a thorough synthesis of these ideas. The use of books promotes "an enthusiasm for learning as well as a foundation for later mathematical accomplishments" (Harsh, 1987, p.28).

Communication

Communication is another important factor in a student's understanding of mathematics (Suydam, 1987). In a typical classroom setting, rather than being encouraged to discuss mathematical ideas, students are expected to work quietly and independently. "Children of all ages would develop much more rapidly in arithmetic, as well as in their general ability to think logically, if teachers would stop correcting worksheets and would instead encourage youngsters to exchange ideas honestly and to argue among themselves" (Kamii, 1982,

p.250). When introducing a new concept it is better to let students discuss possible ways of solving the problem, rather than to impose one correct way upon them from the start. The examination by children of different ideas, even if they are all incorrect, often leads to the discovery of the correct way to solve a problem (Kamii, 1982). In this way students are given an opportunity to construct their own mathematical ideas much as they did before they entered school.

The National Council of Teachers of Mathematics recommends that oral language be an integral part of a mathematics program (Rathmell & Thompson, 1988). As students work together to solve problems they become more confident about their mathematical ability. When they have an opportunity to justify their thinking to a group of peers, they are able to internalize the mathematical concept. Other ways to increase mathematical communication skills include staging student debates about the best way to solve a problem, and questioning students about how they arrived at both right and wrong answers. Because both right and wrong answers can be arrived at by numerous methods, little can be learned by simply looking at students' written work. One helpful device is questioning children to

find out how they arrived at a wrong answer (Brownell, 1987). When students have a chance, through discussion with their teacher and with their peers, to recognize that their mathematical reasoning is correct, they are likely to gain confidence and to attempt more challenging problems (Kamii, 1982).

Discussion

Children enter school with a base of mathematical knowledge, much of it correct. If, within a formal mathematics program, concepts are presented in a way that capitalizes on what children already know, the child's knowledge base can be greatly increased. Mathematics teachers must teach in a way that cultivates, rather than discourages the intuitive mathematical sense within their students. This can be done by continually drawing upon real-life situations, and by helping students to make connections between what they know and what they are learning. If teachers encourage students to rely upon their internal ideas about mathematics throughout their primary school years, then the students will have a heightened intuition about mathematics to guide them through more complex problems later in life.

References

- Ballenger, M., Benham, N., & Hosticka, A. (1984).
Children's Counting Books: Mathematical Concept
Development. Childhood Education, 61(1), 30-35.
- Brownell, W. A. (1987). Meaning and Skill-
Maintaining the Balance. Arithmetic Teacher, 34, 18-
24.
- Della Neve, C., Hart, L. A., & Thomas, E. C. (1986).
Huge Learning Jumps Show Potency of Brain Based
Instruction. Phi Delta Kappan, 68, 143-148.
- Harsh, A. (1987). Teach Mathematics With Children's
Literature. Young Children, 42, 24-29.
- Kamii, C. (1982). Encouraging Thinking in Mathematics.
Phi Delta Kappan, 64, 247-251.
- Lowe, A., Orlando, L. S., & Surat, A. (1987).
Strategies For Developing Critical Thinking in
Mathematics. (Report no. SE048907) Salem, Va:
Roanoke College.
(ERIC Document Reproduction Service no. ED291575)
- Radebaugh, M. R. (1981). Using Children's Literature to
Teach Mathematics. The Reading Teacher, 34, 902-906.
- Rathmell, E. C., & Thompson, C. S. (1988). NCTM's
Standards for School Mathematics, K-12. Arithmetic
Teacher, 38, 17-19.

- Smith, N. J., & Wendelin, K. H. (1981). Using
Children's Books to Teach Mathematical Concepts.
Arithmetic Teacher, 29(3), 10-15.
- Suydam, M. N. (1987). Research on Instruction in
Elementary School Mathematics: A Letter to Teachers
(Report no. SE049116). Washington D. C.: Office of
Educational Research and Development.
(ERIC Document Reproduction no. ED293728)
- Weaver, J. F. (1987). What Research Says: The Learning
of Mathematics. School Science and Mathematics, 87,
66-70.
- Willoughby, S. S. (1988). Don't Be Manipulated by
Manipulatives. Educational Leadership, 45, 88-89.